WE CLAIM:

1. A method of forming a beam of a signal to be transmitted from a base station transceiver in a communication system having a communication channel between a base station and a mobile station and a return channel for data transmitted from the mobile station to the base station, the method comprising:

Providing a codebook (C) of parameters that modify a transmitted signal:
Providing a channel matrix (H) of parameters representing the properties of the channel;
transmitting a signal from the base station along a channel using an antenna comprising at least two elements;
Receiving said transmitted signal in said mobile station and estimating a parameter in the channel matrix characteristic of the channel by selecting the value of a parameter in the codebook that minimizes a criterion;
transmitting an indication of the selected parameter over the return channel and
applying the codebook vector associated with the selected parameter to subsequent transmissions from the base station.

2. A method according to claim 1, in which an eigenvector of said channel matrix is provided by a calculation based on said parameter.

3. A method according to claim 2, in which said calculation is performed in said mobile station.

4. A method according to claim 1, in which said base station transmits a set of initial setup signals that are used by the mobile station to estimate the parameters of the channel.

5. A method according to claim 4, in which an eigenvector of said channel matrix is provided by a calculation based on said parameter.

6. A method according to claim 5, in which said calculation is performed in said mobile station.

7. A method according to claim 1, in which the signal is divided into frames and the process of estimating a parameter, transmitting an indication of the selected parameter and applying the codebook vector is repeated for each frame.

8. A method according to claim 7, in which an eigenvector of said channel matrix is provided by a calculation based on said parameter.

9. A method according to claim 8, in which said calculation is performed in said mobile station.

10. A method according to claim 1, in which said base station transmits a set of initial setup signals that are used by the mobile station to estimate the parameters of the channel.

11. A method according to claim 10, in which an eigenvector of said channel matrix is provided by a calculation based on said parameter.

12. A method according to claim 11, in which said calculation is performed in said mobile station.

13. A method of forming a beam of a signal to be transmitted from a base station transceiver in a communication system having a communication channel between a base station and a mobile station having two antennas and a return channel for data transmitted from the mobile station to the base station, the method comprising:

Providing a codebook (C) of parameters that modify a transmitted signal:
Providing a channel matrix (H) of parameters representing the properties of the channel;
transmitting a signal from the base station along two eigenvectors of a channel, the power allocation between said two eigenvectors being quantized independently from the quantization of the eigenvectors.

14. A method according to claim13, in which the quantization of the power allocation is performed at the receiver.

15. A method according to claim 13, in which $P_1 = kP_2$, where $0 \le k \le 1$, P_1 is the power in the dominant eigenvector and k is selected from the group comprising 1, ½, 1/5, and 0 when $R = \frac{P_2}{P_1}$ is correspondingly ≥ 0.75, $0.5 < R < 0.75$, $.25 < R < 0.5$ and $0 < R < .25$. .

16. A method according to claim 13, in which the dominant eigenvector is quantized by calculating the eigenvector in the relevant codebook that maximizes $\left\| H(C_i^1)^\dagger \right\|_2$.

17. A method according to claim 16, in which the second of two eigenvectors is calculated by finding that vector in an orthogonal subspace to the first eigenvector that maximizes the inner product with a beamformer codebook in the orthogonal subspace to the first codebook.

18. A method according to claim 16, in which the quantization of the power allocation is performed at the receiver.

19. A method according to claim16, in which which $P_1 = kP_2$, where $0 \le k \le 1$, P_1 is the power in the dominant eigenvector and k is selected from the group comprising 1, ½, 1/5, and 0 when $R = \frac{P_2}{P_1}$ is correspondingly ≥ 0.75, $0.5 < R < 0.75$, $.25 < R < 0.5$ and $0 < R < .25$. .

20. A method of constructing a beamformer comprising the steps of:
Providing a unitary space-time constellation of at least one signal $_i$ having a coherence time T and one transmit antenna and applying the constellation as a set of at least one beamforming vectors in an array of T antennas.

21. A method according to claim 20, in which said set of at least one functions have the form $V_i = \frac{1}{\sqrt{n}} \exp(\frac{i2\pi j}{N})$ where $j = 0,1,2...N-1$..

22. A method of constructing a beamformer of N vectors comprising the steps of:
Providing a transmitter system having n transmit antennas;
Forming a set of N functions in a unitary space time constellation with one antenna and a coherence time of n; and
Applying said set of N functions as a set of N beamforming vectors.

23. A method according to claim 22, in which said set of N functions have the form $V_i = \frac{1}{\sqrt{n}} \exp(\frac{i2\pi j}{N})$ where $j = 0,1,2...N-1$..

24. A method according to claim 20, of forming a beam of a signal to be transmitted from a base station transceiver in a communication system having a communication channel between a base station and a mobile station and a return channel for data transmitted from the mobile station to the base station, the method comprising:

Providing a codebook (C) of parameters that modify a transmitted signal according to claim 20:
Providing a channel matrix (H) of parameters representing the properties of the channel;
transmitting a signal from the base station along a channel using an antenna comprising at least two elements;
Receiving said transmitted signal in said mobile station and estimating a parameter in the channel matrix characteristic of the channel by selecting the value of a parameter in the codebook that minimizes a criterion; transmitting an indication of the selected parameter over the return channel and
applying the codebook vector associated with the selected parameter to subsequent transmissions from the base station.